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CURRENT LITERATURE.

BOOK REVIEWS.

Warming's plant geography.

THE GEOGRAPHICAL DISTRIBUTION of plants has received much attention for many years, but the earlier observers could do little more than accumulate facts and outline general zones. With the development of plant physiology it became possible to organize these facts upon a scientific basis, and this organization introduces us into the great modern field of ecology, of which geographical distribution is a conspicuous part. Many recent contributions to this region of ecology are scattered through botanical literature, and the time has come for the summing up of results in some general work. Such a work has been prepared by Dr. Warming, and the German translation by Dr. Knoblauch¹ is now before us. It is impossible to give a compact review of such a work, as it is a compendium of important information; and little more can be attempted than to present a brief outline. It is to be hoped that the promised English translation will put the book promptly into the hands of English students. In the introduction the prominent terms are defined. Floristic plant-geography deals with lists, districts, limits, and causes; ecologic plant-geography, the subject of the book, considers adaptations, sociology, and physiognomy. "Life-forms" (epharmony) and "plant-societies" (Pflanzenvereine) are defined, the latter referring to those plant associations which take possession of certain conditions.

The second section discusses the ecological factors and their effects under the following titles: atmosphere, light, heat, atmospheric moisture and precipitation (water obtained from air and soil is emphasized as being the chief ecological factor), atmospheric movements, nature of the nutrient soil, the structure of the soil, the air in the soil, the water in the soil, the heat of the soil, the depth of the soil, the nutriment in the soil, the kinds of soils, chemical *vs.* physical properties of the soil (the author regards the physical properties as most important, as they control the water supply, which is the most important factor), effects of inanimate coverings on vegetation (snow and

¹ WARMING, DR. EUGEN.—Lehrbuch der ökologischen Pflanzengeographie; eine Einführung in die Kenntniss der Pflanzenvereine. Deutsche vom Verfasser genehmigte, durchgesehene und vermehrte Ausgabe von Dr. Emil Knoblauch. 8vo. Berlin: Gebrüder Borntraeger. 1896. *M.* 7.

fallen leaves), effects of living plant coverings on the soil, activity of animals and plants in the soil, orographic factors (height, steepness, etc.).

The third section considers life-relations and plant-societies under the following subjects: life-relationship of living beings, encroachment of man, life-relationship with animals, life-relationship of plants with each other (parasitism, helotism, mutualism, epiphytes, saprophytes, and lianas), commensalism (plant-societies), classes of societies (amplified in the succeeding chapters).

In section four the hydrophyte societies are considered, the ecological factor being air, light, heat, food-stuffs, specific weight, color, and movements; the structural adaptations noted being in roots, water-conducting vessels, mechanical tissues, air-cavities, epidermis, slime, etc. The different classes of hydrophilous societies are grouped as follows: free-floating or swimming; fixed to the soil, with submerged or floating leaves; and swamp forms. Under the first heading there are four categories, the plankton, glacial plant-unions (ice and snow), saprophilous flagellate unions, and hydrocharite unions (littoral fresh-water free plants). Under the second heading (fixed to soil, with submerged or floating leaves) are plants fixed to stones (nereid-unions), and those fixed to loose soil (sea-grass vegetation, fresh-water vegetation, and schizophyte unions. Under the third heading (swamp plant-societies) the subdivision is into salt water (mangrove vegetation) and fresh water (reed-swamps, swampy moors, sphagnum moors, sphagnum tundras, swampy thickets and woods). Each of these fourteen categories is fully discussed, all the known factors in each situation being considered.

Section five is devoted to xerophyte societies, which involves a full discussion of the adaptations for regulating transpiration and for collecting and preserving water. Under the regulation of transpiration the titles are periodic surface reduction, movements for regulating light, constant profile position (compass plants, etc.), leaves and shoots with reduced surface, covering organs, anatomical structures reducing transpiration, etc. The classification of xerophilous societies is as follows: rock vegetation (subglacial and temperate regions, tropical and dry rock vegetation), subglacial vegetation on loose soil (rocky fields, moss heaths, lichen heaths), dwarf shrub heaths (chiefly ericaceous), sand vegetation (beaches, dunes, sandy fields, etc.), tropical deserts, xerophilous grass vegetation (steppes and prairies, savannas), rocky heaths, xerophilous thickets (in cold and temperate regions, alpine thickets, tropical thorn, palm, fern, bamboo thickets), and xerophilous woods (ever-green conifers, deciduous conifers, xerophilous foliage woods, leafless woods).

Section six considers halophyte societies, the structural adaptations being very marked and often readily modified by removal from halophytic conditions. Naturally halophytes include both xerophytes and hydrophytes, and are grouped as follows: tropical swampy beach vegetation, salt marshes with

herbaceous plants (mostly *Scirpus*-like), rock societies, herb and shrub vegetation in salty sand and gravel, tropical sand-beach woods, leafless halophyte woods in sand, herb and shrub vegetation in clay soil (lagoon thickets, salt steppes), salt deserts, and beach meadows.

The mesophyte societies form the subject of section seven. The general condition is freedom from extremes. The vegetation is rich and dense, and there is great richness in leaf forms. This is the common vegetation of temperate regions and includes the numberless new societies of weeds and culture plants introduced by man. The grouping of mesophyte societies is into grass and herb societies and societies of woody plants. Under the former are included arctic or alpine grass or herb carpets, meadows, pastures on cultivated lands; under the latter, thickets, deciduous woods in temperate zones, and evergreen foliage woods (subtropical, antarctic, tropical rain woods, palm woods, bamboo woods, fern woods).

The last section discusses the struggle between plant societies. After general introductory remarks concerning the nature of the struggle, the facts of overproduction, the easy derangement of the organic equilibrium, etc., the main topics discussed are the production of new soils and their occupation, changes in vegetation induced by slow changes in soil, changes in vegetation without changes in climate or soil, the weapons for the struggle, rare species, the origin of species. We have space for fuller statement of but two of these topics. The general characteristics of vegetation occupying new soil are given as follows: The first vegetation is sparse and open; the number of species is small at first, then larger when the physiognomy is diverse, then comes an equilibrium and fewer species; annuals and biennials are common at first, but afterwards subordinated to perennials; the first species are those whose seeds are carried by winds and birds; light-trees appear before shade-trees; there is a gradual transition to former conditions, and thus there may be primal, transitional and final plant societies. In reference to the origin of species, the author believes that plants possess an innate power of adapting themselves directly to new conditions, a view which he supports by numerous illustrations of direct response of plants to changed conditions. This he regards as one of the greatest factors in the evolution of plants. Others are acquired variability, depending upon descent and not environment; natural selection; crossing of species; and correlation between the parts of a plant, a change in one part affecting the others.

The book certainly meets the demands of a "*Lehrbuch*" admirably, being comprehensive and yet full enough of details. Its arrangement is to be highly commended, as the numerous subdivisions enable one to find any special topic at a moment's notice. Very few references are made to American plant-societies, chiefly because they have not been investigated sufficiently.—
J. M. C.